3

Innovative Research Approaches for Sustainable Livestock Production and Poverty Reduction in the Developing World

P. Kristjanson

Interrnational Livestock Research Institute (ILRI)
Nairobi, Kenya

Summary

Livestock-related research that aims to increase productivity and enhance livelihoods in an environmentally sustainable manner in the developing world is no longer taking a 'business as usual' approach. Innovative new approaches involve interdisciplinary teams linking up with diverse partners. They recognize the multiple roles and functions that livestock play for poor households, identify and tackle institutional, market and policy-related constraints and not just technical constraints, take an innovation systems approach, and employ gender analysis and strategies to ensure poor women's access to, and benefits from, livestock improve. The 'multifunctionality' of livestock for the poor, coupled with the severe institutional, policy and governance constraints found in most developing countries, means that how livestock researchers engage with partners, and how they do and communicate their science, matter even more than they do in Europe or North America. There are a wide range of approaches and tools available that can help enhance both the effectiveness (impact) and efficiency of taking an innovation systems approach. These include processes aimed at lowering the transactions costs involved in developing public-private partnerships and learning platforms. More use of innovative methods such as outcome mapping/impact pathway analysis, social network analysis, innovation histories, cross-country analyses, and game-theory modeling can help improve the likelihood that new knowledge generated by livestock research will lead to actions that help sustainably reduce rural poverty in the developing world.

Resumen

Nuevos enfoques sobre la investigación para el desarrollo sostenible de la producción ganadera y la reducción de la pobreza en el mundo en desarrollo

La investigación ganadera que pretende aumentar la productividad y mejorar la vida de manera sostenible en un mundo en desarrollo ya no se lleva a cabo de la forma tradicional. Las nuevas tendencias implican la participación de equipos interdisciplinarios vinculando a varios colaboradores. Se reconocen los múltiples papeles y funciones que los animales juegan en los hogares pobres, se identifica y se analizan desde el punto de vista institucional, de mercados y de políticas relacionadas con limitaciones, se adopta un enfoque innovador y se

analizan las estrategias para garantizar el acceso de las mujeres pobres a los beneficios de la mejora de la ganadería. La "multifuncionalidad" de la ganadería de los pobres, junto con la política institucional y las limitaciones graves de la mayoría de países en desarrollo, hace que los investigadores en producción animal de estos países se relacionen con sus colaboradores para comunicar sus resultados científicos incluso más que en Europa o América del Norte. Se presenta una amplia gama de propuestas y herramientas disponibles para ayudar a mejorar tanto la eficacia (impacto) como la eficiencia al adoptar sistemas innovadores. Estos incluyen procesos encaminados a reducir los costos de transacción implicados en el desarrollo de asociaciones público-privadas y plataformas de aprendizaje, además de un mayor uso de métodos innovadores como análisis de las rutas de impacto, de redes sociales, la evolución de las innovaciones, la comparación entre países, y la modelización pueden ayudar a mejorar la probabilidad de que los nuevos conocimientos generados por la investigación ganadera den lugar a acciones que contribuyan de manera sostenible a reducir la pobreza rural en los países en desarrollo.

Introduction

Livestock production systems in the developing world differ substantially from those in the developed world, and present unique challenges. These challenges are not just about raising productivity *per se*, but also involve addressing needed behavioral, policy, infrastructural, marketing and institutional changes. This paper discusses these challenges and some of the lessons learned in addressing them by scientists at the International Livestock Research Institute (ILRI), which has been working in livestock systems across the developing world for many years. ILRI pursues sustainable poverty reduction through livestock via three poverty pathways (ILRI, 2008):

Securing Assets and reducing vulnerability. Livestock play a crucial role in rural economies of most developing countries by facilitating capital accumulation (physical, financial, human social and natural) and moving households out of poverty (Moser, 2007; Burke et al., 2007; Kristjanson et al., 2007). Beyond material wealth, assets provide the basis of agency–the "power to act, to reproduce, challenge or change the rules that govern the control, use and transformation of resources" (Sen, 1997). Recent research on livelihoods and poverty dynamics emphasizes the importance of assets for poor households (Carter and Barrett, 2006).

Along with allowing poor households (and often women) to accumulate assets, livestock play multiple roles and provide many valuable services, including enabling saving, providing security, financing planned expenditures, providing livestock products (meat, milk, eggs, manure, draught power), and maintaining social capital (LID, 1999; Ashley and Nanyeena, 2002).

Sustainably improving productivity. There are many ways in which the productivity of livestock systems of the poor can be sustainably improved. The use of different management options benefits the livelihoods, assets, health and environments of the poor in different ways and degrees. Basically, these options involve improved strategies and technologies for feeds, breeds and animal health, contributing to the following goals:

- Increasing the quantity and quality of livestock feed supplies through use of locally available and low-cost tropical feed sources.

• Developing the means to improve feed-use efficiencies in milk and meat production under harsh tropical conditions.

• Developing breeding strategies that promote use of diverse indigenous livestock to increase smallholder productivity.

• Reducing the burden of endemic infectious tropical livestock diseases through development of integrated disease-control packages that are robust, efficacious, affordable by the poor and safe for the environment.

Animal disease not only threatens the ability to accumulate livestock assets, it also lowers livestock productivity, and zoonotic disease (those transferred from animals to people) endangers the health of livestock-dependent people (also affecting productivity). Around two-thirds of all diseases and three-quarters of emerging diseases are zoonotic, and food-borne disease is the single most common disease in the world. Most of food-borne diseases, in fact, come from animal source foods (Randolph et al., 2007; Perry and Grace, 2009).

Improving Market Opportunities. Because livestock market chains are long and complex, they provide multiple opportunities for the poor to participate through input and service supply, and in myriad ways in the marketing and processing of livestock products. The poor can be found playing important roles all along the value chain, but they, particularly women, can also often be shut out of formal markets. A value chain approach expands the range of available research entry points, since it typically involves diagnosing linkages between various players and identifying opportunities and possible innovations.

There are livestock value chains that can be identified as particularly important to poor households, including dairy cattle, small ruminants, pigs, backyard poultry, and fish. These vary across different regions and are influenced by policies, institutions, agro-climatic conditions and socio-economic factors. ILRI's main lesson with respect to improving productivity of small livestock farmers is that it can indeed be done through a value chain approach, and requires attention to integration of feed, breeds and animal health issues (van der Zijpp et al., 2009).

Principles for livestock research that matters

ILRI has recently developed some principles providing guidance on how research can maximize desired poverty and environmental impacts, arising from empirical examples and lessons learned across a wide range of collaborative livestock-related projects (Kristjanson et al., 2009; Pell et al., 2009). These principles have been found to help increase the likelihood that livestock research and development efforts will contribute to sustainable poverty reduction (i.e. poverty reduction that does not deplete the natural resources that sustain people and animals) across the developing world. Four of these principles are discussed below. They begin with the proposition that 'Livestock research and development efforts aimed at sustainable poverty reduction are more likely to be successful if':

1. Livestock are seen within the greater context of peoples' *livelihood strategies,* accounting for the fact that the resource-poor typically have more pressing concerns than raising the productivity of their livestock enterprises (e.g. increasing food prices, conflict, land and labor

constraints). The *multiple roles* that livestock play for the poor also need to be recognized and the implications understood. These include enabling saving, providing security, accumulating assets, financing planned expenditures, providing livestock products (meat, milk, eggs, manure, draught power), improving household nutrition, and maintaining social capital.

2. Institutional, market and policy-related constraints are identified and tackled and not just technical constraints.

3. Interdisciplinary research taking an innovation systems approach is needed. Such an approach often includes collaborations with local communities, and engagement with public sector, private sector, NGOs, CSOs, as well as development practitioners and researchers.

4. Gender analysis and approaches to ensure poor women's access to, and benefits from, livestock are improved.

Livestock and livelihood strategies. Placing livestock production and marketing issues within the greater context of peoples' livelihood strategies is much more important in the developing versus the developed world. Of the 1.3 billion people living in absolute poverty worldwide in 2003, an estimated 600 million of them were livestock keepers (Thornton et al., 2003). That figure is surely close to, if not over, one billion today. A close interaction between crops and livestock is found across the developing world. Mixed crop-livestock systems account for most of the meat and milk produced in Asia and 40-60% of the cattle, sheep, goat and poultry meat production in sub-Saharan Africa (Herrero et al., 2009). These resource-poor households are typically growing crops (often on a subsistence level), earning whatever off-farm income they can, and raising a few chickens, sheep, goats, pigs or cattle on a few hectares (or less) of land.

In Africa, grazing systems are also important, contributing nearly two-thirds of cattle meat and three-quarters of milk production (Herrero et al., 2009). With huge population growth still underway in both mixed crop-livestock and grazing systems, serious water, land and labor constraints exist in these systems (World Bank, 2008). Farmers and pastoralists often have few options open to them for enhancing their household welfare (Little et al., 2008). Facing concerns such as increasing food prices, insecurity and conflict, their highest priorities often do not lie in taking up new technologies or livestock management strategies.

Livestock play multiple roles for the poor. They enable saving, provide security, allow resource-poor households (and women, who typically cannot own land) to accumulate assets, help finance planned expenditures as well as unplanned events (e.g. illness), provide livestock products including meat, milk, eggs, manure and draught power, improve household nutrition and help maintain social capital and status within communities. These multiple roles are not as critical in the developed world, where families have insurance and bank accounts. Few livestock research for development projects consider these multiple roles from the outset – most focus on individual elements, such as feed efficiency, or a particular disease or breed.

In response to the need to consider the multifunctionality of livestock, Dorward et al. (2005) and Misturelli et al. (2003) have developed guides/toolkits that provide methods and indicators for assessing the contribution of livestock keeping to livelihoods of poor people and to assess poverty and well-being among poor livestock keepers. These are helpful to enhance our

understanding of both the needs and strengths of the poor within the livestock sector; for appraisals of new technology developments in research; prioritisation and design of potential changes and interventions to improve the livelihoods of poor livestock keepers; participatory monitoring and evaluation of projects seeking to improve the livelihoods of poor livestock keepers; retrospective assessment of the impact of changes in livestock keeping on livelihoods, and of differentiated livelihood impacts across different groups of people (e.g. the poor, or women).

An assessment of the potential for livestock interventions to reduce poverty considered three approaches to livestock development: the first one focused on increasing market supplies of livestock products for consumption by the poor; the second approached aimed at increasing the demand for labour and services of the poor by creating growth in the livestock sector; and the third approach involved working directly with the poor to enhance the contribution livestock make to their livelihoods (LID, 1999). Of the three, the livelihood-based approach was found to be likely to have the greatest impact on rural poverty. The study team concluded the reason for this is that the majority of the poor rear livestock, but many face constraints that – if resolved – can increase the contribution livestock make to their livelihoods. They concluded that livestock development – if correctly targeted towards supporting the livelihoods of the poor – offers much potential as a tool for reducing rural poverty (LID, 1999).

Institutional, market and policy-related constraints. These constraints are particularly important in countries where agricultural decision makers, research and extension services are lacking resources and capacity. The roads, markets and institutions (e.g. contract enforcement) underlying efficiently operating markets are often severely lacking in areas where livestock is raised (Pica-Ciamarra, 2005). Appropriate policies and supportive institutions, together with technology, are critical, and traditional research approaches seldom are effective in catalyzing needed changes. Improved dairy policies in East Africa, for example, have had significant benefits for the poor, but dairy researchers had to pursue multiple strategies and collaborative extensively over many years in order to influence those policy changes (Kaitibie et al., 2010). What this implies is that approaches and tools that help researchers better understand the institutional constraints and identify strategies to overcome them are needed if the desired outcomes are to be achieved. Mapping the output-outcome-impact pathways, for example, is one useful tool (Douthwaite et al., 2003; Earl et al., 2001).

Innovation Systems research. Recent agricultural revitalization efforts call for an Agricultural Innovation Systems (AIS) approach (Hall et al., 2001; Scoones and Thompson, 2009; World Bank, 2007). Spielman (2005) defines an *innovation system* is as a set of interrelated agents, their interactions, and the institutions that condition their behavior with respect to the common objective of generating, diffusing, and utilizing knowledge and/or technology. Taking an innovation systems approach thus involves changes in the incentives, support structures and policy environments that encourage innovation, allowing innovation to occur (Hall et al., 2005). Understanding who the key actors are, along with their roles, behaviours and practices, and the institutional context within which they interact are key (World Bank, 2006). The role of the private sector, and building public-private partnerships (and the huge challenges in doing so) is also increasingly being recognized as important in supporting agricultural sector innovation (Spielman and von Grebmer, 2004).

Agricultural education and training, conventionally viewed in terms of its role in building human and scientific capital, also has a vital role to play in building the capacity of organizations and individuals to transmit and adapt new applications of new information, new products and process, and new organizational cultures and behaviours (Davis et al., 2007, Scoones and Thompson, 2009; Spielman et al., 2009). An innovation systems approach implies that agricultural research and development efforts should focus on increasing the knowledge and capacities of farmers' organizations to innovate, strengthening of networks and alliances to support, document and share lessons on farmer-led innovation, and the transformation of agricultural higher education. Methods such as social network analysis, innovation histories, cross-country analyses and game-theory modeling have been found helpful in applying this approach (Spielman et al., 2009).

At a project level, taking an innovation systems approach involves first identifying the boundaries of the system and then targeting key partners, sometimes referred to as 'boundary partners' (Earl et al., 2001) and creating the incentives and space for collaborative work with these partners (Kristjanson et al., 2009).

Gender analysis and approaches. Livestock research and development efforts aimed at sustainable poverty reduction are more likely to be successful if gender analysis and approaches to ensure poor women's access to, and benefits from, livestock are incorporated. Interventions that increase women's access to and control over assets have been shown to improve food security, child nutrition, and education (Quisumbing, 2003; Smith, 2003). A recent literature review highlighted critical issues that affect and can enhance or limit opportunities for improved well-being of women and their families through livestock-related activities – these included women's ownership and control of livestock and livestock profits, women's access to capital and livestock markets, health and nutrition (both human and animal) concerns, urban livestock and health and food safety, livestock services delivery, women's groups, and issues related to risk, vulnerability and climate change (Tipilda and Kristjanson, 2008). It concluded that rigorous research and peer-reviewed articles in this area remain limited; much of the knowledge on this topic comes from unpublished, non-academic sources, providing valuable but still quite limited field experience and lessons as to what is working where, how and why with respect to livestock-related efforts that are enhancing the well-being of poor women and their families.

Conclusions

What does the large range of roles and functions that livestock play throughout the developing world imply for researchers interested in development? We've presented a set of principles that some diverse project experience (supported by the literature) suggests can help increase the likelihood that livestock research for development efforts will contribute to sustainable poverty reduction. This experience leads us to the conclusion that how the research is done matters, a lot. This seemingly simple statement has huge implications for future research and educational approaches, however. It implies, first and foremost, that including diverse partners is critical to such efforts. Complex partnerships are never easy, however. The objectives of individual partners and organizations will vary considerably, and will not always be initially in line with

overall project objectives. Furthermore, nurturing these partnerships generally involves fairly high transactions costs (particularly researcher's time). Students and young researchers need to be exposed to training and tools, processes and strategies that help limit the transactions costs and increase the efficiency and effectiveness of such partnerships.

Livestock researchers also have to realize that tackling technical constraints in these systems is seldom sufficient, due to widespread institutional, market, gender-related and policy-related constraints that exist. Including policymakers as integral partners in projects (e.g. having a policy advisory group) is one strategy for addressing this. Projects that include gender analyses and participatory processes often succeed at not only identifying these types of constraints, but also strategies for dealing with them. Finally, interdisciplinary teams that take a systems approach are more likely to have the necessary expertise to deal with these broader issues.

It is important to emphasize that with respect to the huge challenges identified in this paper, there are many tools, processes, lessons and strategies that are relevant and can help research teams face these challenges. These include processes aimed at efficiently and effectively developing public-private partnerships and developing learning platforms. Methods such as outcome mapping/impact pathway analysis, social network analysis, innovation histories, cross-country analyses and game-theory modeling have been found helpful (Kristjanson et al., 2009; Spielman et al., 2009). Enhanced investment and more applications of these innovative new approaches to agricultural education, research and extension are key to 'linking knowledge with actions' that help sustainably reduce rural poverty in the developing world.

References

Ashley S, Nanyeenya W. 2002. More than Income: Pro-Poor Livestock Development Policy in Uganda. Livelihoods and Diversity Directions Explored by Research (LADDER) Working Paper No.8. UK Department for International Development (DFID), UK. http://www.research4development.info/casestudies.asp?ArticleID=132

Burke WJ, Jayne TS, Freeman HA, Kristjanson P. 2007. Factors Associated with Farm Households' Movement Into and Out of Poverty in Kenya: The Rising Importance of Livestock. MSU International Development Working Paper No. 90, with ILRI. Available at: http://www.aec.msu.edu/fs2/papers/idwp.htm

Carter, M.R. and C.B. Barrett. 2006. 'The Economics of Poverty Traps and Persistent Poverty: An Asset-Based Approach,' *Journal of Development Studies* 42(1):178-199.

Davis K, Ekboir J, Mekasha W, Ochieng CMO, Spielman DJ, Zerfu E. 2007. Strengthening Agricultural Education and Training in Sub-Saharan Africa from an Innovation Systems Perspective. Case Studies of Ethiopia and Mozambique. IFPRI Discussion Paper 00736. IFPRI. Washington DC. USA.

Dorward A, Anderson S, Nava Y, Pattison J, Paz R, Rushton J, Sanchez Vera E. 2005. A guide to indicators and methods for assessing the contribution of livestock keeping to the livelihoods of the poor. Department of Agricultural Sciences, Imperial College London.

Douthwaite, B., T. Kuby, E. van de Fliert and S. Schulz. 2003. Impact Pathway Evaluation: An approach for achieving and attributing impact in complex systems. Agricultural Systems 78 pp243-265.

Earl S, Carden F, Smutylo T. 2001. Outcome Mapping: Building learning and reflection into development programs. Published by IDRC (International Development Research Centre) 120 pp. ISBN 0-88936-959-3.

Hall AJ, Sivamohan MVK, Clark NG, Taylor S, Bockett G. 2001. Why research partnerships really matter: innovation theory, institutional arrangements and implications for developing new technology for the poor. *World Development* 29(5): 783–797.

Hall A, Mytelka L, Oyeyinka B. 2005. Innovation systems: Implications for agricultural policy and practice. CGIAR Institutional Learning and Change Program (ILAC). *ILAC Brief 2 2005. Available at www.cgiar-ilac.org*

Herrero M, Thornton PK, Notenbaert A, Msangi S, Wood S, Kruska R, Dixon J, Bossio D, van de Steeg J, Freeman HA, Li X, Parthasarathy Rao P. 2009. Drivers of change in crop-livestock systems and their potential impacts on agro-ecosystems services and human well-being to 2030. A study commissioned by the CGIAR systemwide Livestock Programme. SLP, International Livestock Research Institute, Nairobi, Kenya. < http://www.vslp.org/vslp>

ILRI. 2008. Climate, Livestock and Poverty: Challenges at the Interface. International Livestock Research Institute. Corporate Report 2008-09. ILRI, Nairobi, Kenya. Available at: www.ilri.org

Kaitibie S, Omore A, Rich K, Salasya B, Hooten N, Mwero D, Kristjanson P. 2010. Kenyan dairy policy change: Influence pathways and economic impacts. *World Development*. Forthcoming.

Kristjanson P, Reid R, Dickson N, Clark WC, Romney D, Puskur R, MacMillan S, Grace D. 2009. Linking International Agricultural Research Knowledge with Action for Sustainable Development. *Proc Natl Acad Sci USA 9*(13):5047-5052.

Kristjanson P, Krishna A, Radeny M, Kuan J, Quilca G, Sanchez-Urrelo A, Leon-Velarde C. 2007. Poverty Dynamics and the Role of Livestock in the Peruvian Andes. *Agricultural Systems 94:294–308.*

Livestock in Development. 1999. *Livestock in Poverty-Focused Development*. Crewkerne: Livestock in Development. < www.theidlgroup.com/documents/IDLRedbook_000.pdf>

Little PD, McPeak J, Barrett C, Kristjanson P. 2008. Challenging Orthodoxies: Understanding Pastoral Poverty in East Africa. *Development and Change* 39 (4): 585-609.

Misturelli F, Nielsen L, Pilling D. 2003. The Livestock and Poverty Assessment Methodology: A toolkit for practitioners**.** The Livestock Development Group, School of Agriculture, Policy and Development, University of Reading, Reading, UK <http://www.livestockdevelopment.org/adobedocs/LPA%20Manual.PDF>

Moser C. (ed). 2007. Reducing Global Poverty: The Case for Asset Accumulation. Brookings Institution Press: Washington, DC.

Pell A, Stroebel A, Kristjanson P. 2009. What works, what doesn't and why: Development projects that make a difference. In: Proceedings of the 10th World Conference on Animal Production, Capetown, Nov. 23-28, 2008.

Perry B, Grace D. 2009. The impacts of livestock diseases and their control on growth and development processes that are pro-poor. *Phil Trans R Soc B* 364, 2643-2655.

Pica-Ciamarra U. 2005. Livestock Policies for Poverty Alleviation: Theory and Practical Evidence from Africa, Asia and Latin America. FAO Pro-Poor Livestock Policy Initiative. FAO, Rome, Italy. http://www.fao.org/ag/againfo/projects/en/pplpi/docarc/wp27.pdf

Quisumbing A. (ed.) 2003. Household decisions, gender and development: A synthesis of recent research. Washington, DC: IFPRI.

Randolph T, Grace D, Schelling E. 2007. The role of livestock in developing countries. *Journal of Animal Science* 85:2788–2800.

Scoones I, Thompson J. (eds). 2009. Farmer First Revisited: Innovation for Agricultural Research and Development. Institute for development studies <http://www.ntd.co.uk/idsbookshop/details.asp?id=1095>

Sen AK. 1997. Choice: Welfare and Measurement. Cambridge, Mass.: Harvard University Press. Cambridge, Mass.

Smith L. *et al.* 2003. The importance of women's status for child nutrition in developing countries. IFPRI Research Report 131. Washington, DC: IFPRI.

Spielman DJ, Ekboir J, Davis K. 2009. The art and science of innovation systems inquiry: Applications to Sub-Saharan African agriculture. Technology in Society xxx (2009) 1–7

Spielman DJ. 2005. Innovation Systems Perspectives on Developing-Country Agriculture: A Critical Review. ISNAR Discussion Paper 2. Washington, DC: International Food Policy Research Institute.

Spielman DJ, von Grebmer K. 2004. Public–Private Partnerships in Agricultural Research: an analysis of challenges facing industry and the Consultative Group on International Agricultural Research. Environment and Production Technology Division Discussion Paper No. 113. Washington, DC: International Food Policy Research Institute.

Thornton PK, Kruska RL, Henninger N., Kristjanson PM, Reid RS, Robinson TP. 2003. Locating poor livestock keepers at the global level for research and development targeting. *Land Use Policy* 20(4): 311-322.

Tipilda A, Kristjanson P. 2009. Women and Livestock Development: A Review of the Literature. International Livestock Research Institute (ILRI) Innovation Works Discussion Paper 01-09. ILRI, Nairobi Kenya. URL http://www.ilri.org/innovationworks, accessed Aug. 9, 2009.

Van der Zijpp A, Harringon L, Hegde N, Mack N. 2009. Report of the Center Commissioned External Review on "Sustainable intensification of crop-livestock systems" at ILRI. ILRI, Nairobi, Kenya.

World Bank. 2008. Agriculture for Development. World Development Report 2008. Washington, DC: World Bank.

World Bank. 2007. Cultivating Knowledge and Skills to Grow African Agriculture. A Synthesis of an Institutional, Regional, and International Review. Washington, DC: World Bank.

World Bank. 2006. Enhancing agricultural innovation: How to go beyond the strengthening of research systems. Washington, DC: World Bank.